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faction of all immediately concerned, and to the instruction and guidance of others. The remedy for the excessive love of money would be found in the substitution of other and higher objects of ambition. This could not be expected at this stage of our nation's growth, but it would come with greater maturity. This age, he said, was the seed-time, and not the harvest; nor could the full corn appear until after the intermediate stages of the blade and ear.

THE PRESENT SUN-SPOT MAXIMUM.

AT p. 72 of the second volume of this journal, the observations of the solar spots, made during the previous six years by Professor Todd, now of Amherst college, were collated, and the inference drawn that the present maximum of spots had already passed at the middle of the year 1883. The remarkable solar outbursts, occurring at intervals throughout that year, and the continued manifestation of spot-activity during the present year, have led to renewed discussion of this subject abroad, where very different views are held by the leading authorities in solar physics. Dr. Wolf of Zurich inclines to the belief that we have not yet the data for determining accurately the epoch of maximum; much the highest *monthly* maximum having occurred in April, 1882, while the relative number expressing the spot-prevalence for the year 1883 is easily seen to be greater than that for the year previous. Faye thinks the maximum undoubtedly past, and regards the spottedness during 1883 as "just such secondary maxima as 'might well occur in the progress of a periodic phenomenon which passes rapidly and without hesitation from a minimum to the following maximum, but which passes gently by a series of secondary oscillations from the maximum to the following minimum,' as it is well known the solar spots do." Wolf states, that in 1882 there were no days without spots, while there were four such in 1883. Tacchini of Rome concludes, from the spot-observations of 1882 and 1883, that the solar activity has been on the increase during the latter year: "for, although the difference in the number of spots is very small, the number of groups in 1883 has been very much greater, and the extent of the spots has been truly extraordinary: it has been double that of 1882."

Dr. Spoerer of Potsdam calls attention to a question regarding the numbers, and positions on the solar surface, of the spots observed during the past thirty years. While it has long been recognized that the spots are most numerous, not at the solar equator, but in zones of solar latitude about 15° to 20° , Spoerer's discussion emphasizes the fact, "that, from the time of one minimum until the next, the region of greatest spot-frequency gradually drifts downward from the zone 30° to 25° , to the immediate neighborhood of the equator, and that about the time of maximum its seat lies about 17° or 18° . As the next minimum period is approached, spots more than 15° from the equator gradually become rarer than spots of 35° latitude and upwards were at the time of maximum. But

directly the time of minimum is past, spots begin to appear again in those higher latitudes where but very few, perhaps not a single one, had been seen for several years." As justly remarked by the editor of the *Observatory*, this law of sudden transfer of spot-activity from one zone to another is one of the most striking revelations of solar research, and must be accounted for by that theory of spot-periodicity which would be accepted as satisfactory.

Regarding the determination of the present spot-maximum, the same writer observes, that the chief difficulty lies in a variety of opinion regarding what class of data is to be accepted as affording the true index of the state of solar activity. The unusual magnetic perturbations have occurred in coincidence with "the appearance or rapid development of some single spot or group of spots of abnormal extent," and not at the same time with the existence of great numbers of small spots. It would appear, thus, most likely that the total spot-area, rather than spot-numbers, should be taken as the true index.

GUYOT'S VIEW OF CREATION.

Creation; or the biblical cosmogony in the light of modern science. By ARNOLD GUYOT, LL.D. New York, Scribner's Sons, 1884. 16+139 p., 9 pl. 16° .

THE great eminence of Professor Guyot in several departments of science is a guaranty that what he writes is worthy of attention. The singular simplicity and clearness of his style make what he writes interesting. But, more than all, the earnestness, the truth-loving sincerity, and deep devoutness of the man, in all he wrote, or said, or did, take captive the reader, or hearer, or companion, and bear him along by the force of sympathy. There has been no teacher in this country who has inspired his classes with deeper personal love, or profounder reverence. To us who knew him well, his very presence was a benediction. It is hardly necessary to say, therefore, how deeply and sincerely we sympathize with the devout spirit which pervades this his latest book, and the noble aim of the author in publishing it. Surely, if we must have reconciliations of this kind between the geological record and the Mosaic cosmogony, this one is the noblest and the most rational which we have yet seen. If any one's declining faith still requires such *tonic*, we most cordially recommend this one; but it has long seemed to us that a *complete change of air* is the better, indeed the only, remedy. We believe that the time is rapidly approaching, if it has not already come, when the whole subject must be looked upon from a different and higher point of view. We have ourselves, in earlier years,

undertaken to make such schemes of reconciliation, and that which we finally and somewhat laboriously constructed was very similar to that of Professor Guyot. But latterly we have thrown all such aside, as belittling a transcendently great and serious subject. But for those who think differently, we give a very brief account of the book, with some reflections thereon.

Professor Guyot's scheme differs from many others in the fact that his first two days are wholly cosmic, and not terrestrial. First comes, of course, the creation of matter, its chaotic or nebulous condition, and the energizing of it by the brooding spirit. This is preparatory. Then, as the first day's work, is the creation of light. This, according to Guyot, was the condensation of the nebulous mass by gravity, and the consequent development of heat and light. The second day's work is the creation of the firmament, or *expanse*. The expanse here spoken of is the interplanetary space. This day, therefore, corresponds to the formation and separation of the planets (the earth among the number) from the still nebulous sun. The scene is now transferred to the earth, and the correspondence is henceforward with the geological record. The third day's work was the separation of land and water (by unequal contraction of the earth), and the creation of plants; at first, according to our author, only of the lowest kinds (protophytes). This corresponds to the early archæan. The fourth day's work was the placing in the heavens of sun, moon, and stars, for marking of days and nights, and times and seasons. This, according to our author, was the *first appearance* of the heavenly bodies by the clearing of the sky, heretofore completely obscured by clouds of vapor. This was a necessary preparation for animals and higher plants. It corresponds to later archæan. The work of the fifth day was the creation of animals (and our author thinks many higher plants also), monsters of the deep, creeping things, and fowl of the air. This corresponds to the whole paleozoic and mesozoic. The work of the sixth day was, first, the creation of four-footed beasts (mammals), and afterwards of man. This corresponds to the cenozoic or tertiary, and quaternary. The seventh day was rest, — no creative work, no new continents, no new organic forms. This corresponds to the psychozoic, or present. Throughout, of course, the days are regarded as cosmogonic, not solar days.

Such is a very brief sketch of the scheme. Those who wish to understand it more fully,

and especially to see the skilful way in which the details are worked out, must read the book.

A few words now in the way of reflection and criticism. Professor Guyot draws special attention to the fact, that the word *bara* ('create') is used in connection with only three events; viz., the creation of matter, of sentient life (animals), and of spirit (man). In connection with other events, another word is used. He makes much of this in connection with the apparent chasm which exists between inorganic forces and life, and between the sentient soul (*anima*) of animals and the self-conscious spirit of man. Certainly there are great gaps at these points; but surely science would place the second one, not between plants and animals, but between plants and minerals. The *bara*, therefore, should come, not on the fifth day, but on the third.

Again: Professor Guyot assumes that life is an immaterial principle, not correlated with the other forces of nature as these are with each other, and connects this with the apparent impossibility of abiogenesis, or origin of life by inorganic forces; and this, again, with the necessity, as he thinks, of a rupture of the continuity of nature, and of a supernatural interference at the time of introduction of life on the surface of the earth. Now, as to the first point: we think that nearly all scientific men believe that life-force is derivable, and in fact is always derived, from physical and chemical forces, under appropriate conditions. One of these necessary conditions seems *now* to be the *previous existence* at the very place and time of *living* matter. Abiogenesis seems *now* to be impossible. Life is a necessary condition of derivation of life-force, but none the less is it derived from lower forces by transmutation.

This brings us to the second point. Most persons, even many scientific men, seem to think that the truth of the doctrine of evolution is conditioned on the occurrence, or at least the possibility, *now*, in this geological epoch, of abiogenesis. We do not think so: on the contrary, we think that the impossibility of abiogenesis *now* is exactly what a clear conception of the law of evolution would lead us to expect. The mistake which leads some to imagine that abiogenesis is a necessary corollary of evolution is of the same kind as that which leads some persons to imagine that evolution implies the capability of any one of the lower animals to develop into man. Golden opportunities in evolution occur *but once*. Birds, doubtless, came from reptiles; but this is not going on now. Reptiles came through amphibians from fishes, but a salmon may not

hope ever to change into a lizard. One of the greatest steps in evolution was the origin of life, but it is unreasonable to suppose that the concurrence of favorable conditions necessary for this step could occur only once in the history of the earth. The impossibility of abiogenesis *now* is, therefore, no argument against an abiogenesis once in the early history of the earth.

Again: the author, while he admits that evolution is not necessarily destructive of the idea of a guiding intelligence in nature, while he insists on the necessity of supernatural interference only at the three points mentioned above, thus implying that evolution may possibly take charge of the process in the intervening time, yet plainly inclines strongly to the supernatural origin of species. Along with many other deeply religious minds, he seems to shrink from the cordial recognition of the law of evolution as if it dispensed with the necessity of a God in nature. But surely this is no more true of evolution than of any other law of nature. If the law of gravitation did not destroy our belief in a divine sustainer of the cosmos, why should the law of evolution destroy our belief in a divine Creator? If the law of gravitation be nought else than the divine method of sustentation, then is the law of evolution naught else than the divine process of creation.

One thing more: the present epoch is supposed by the author to differ from all previous ones in the fact of *rest from creative work*. We cannot allow that this is the decision of science. The very possibility of a science of geology is conditioned on the continuance of geological changes, i.e., of creative work, under our eyes.

In conclusion, we must say, that, given the point of view, the frame of mind of the author, — a frame of mind still the most common among religious men, — the book is undoubtedly deserving of much praise as the very best of its kind. But we feel sure that the frame of mind of the religious world is on the eve of change, and, with the change, the '*raison d'être*' of the book will no longer exist.

TRYON'S CONCHOLOGY.

Structural and systematic conchology (etc.). By GEORGE W. TRYON, jun. Vol. iii. Philadelphia, *The author*, 1884. 453 p., 49 pl. 8°.

THE final volume of Mr. Tryon's work has appeared, including over four hundred and fifty pages of text and about fifty plates. It treats of the pulmonate gastropods, the Scaphopoda

or Dentalia, the lamellibranchs, and the brachiopods, and contains an appendix with numerous additions and rectifications and an index of genera comprising nearly sixty-five hundred different names. We have previously referred to what we consider the defects of the plan and of some of the details of the earlier volumes, — defects which this one shares to a certain extent. Nevertheless, as it is in large part a treatise on groups which the author has made the subject of special study, he has made it by far the best of the three, — a fact which it gives us pleasure to recognize. In spite of the criticism which the work as a whole has seemed to us to call for, it is only fair to the author to point out the immense labor required to bring together the material condensed in the two descriptive volumes, and the service which this condensation, in spite of certain defects, will render to workers in conchology and paleontology. The devotion with which the author has applied himself to the study of mollusks for years, has not been fruitless; and here and there in the text most students will find scattered opinions and remarks which will recommend themselves as sound and judicious. While the character of the illustrations cannot be said to be satisfactory, yet they are in most cases sufficiently recognizable to be of service to him who knows what he seeks. If we fail to find in the systematic arrangement that grasp of the subject which might be wished for, and that exposition of recently developed truths one naturally seeks in the newest book, yet we recognize the benefit the author has conferred on specialists, at the cost of an enormous amount of drudgery, by bringing into reasonable orderliness, from innumerable scattered sources, the names and descriptions of thousands of generic forms. For this the work will be welcome in many libraries.

STEAM-ENGINE INDICATORS.

The Tabor steam-engine indicator. By GEORGE H. BARRUS, S.B. New York, 1884. 75 p. 24°.

THE preface of this little handbook states that it was prepared at the solicitation of the Ashcroft manufacturing company, makers of the Tabor indicator, as a book of reference and instruction to purchasers and others.

The subject of principal interest in the book is, of course, that of the construction and performance of the Tabor indicator, especially as compared with other indicators; although there is, besides this, a variety of useful matter, tables, etc.